An Observational Study of Intrathoracic Pressure changes and Stroke Volume Variation associated with Abdominal Insufflation, Ventilator Management, and Patient Positioning

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Background

I. Esophageal pressure (Pes) is a commonly accepted method of determining transpulmonary pressure, as well as an adequate estimation of intrathoracic pressure[1]
II. Stroke volume variation (SVV) has been shown to predict fluid responsiveness in mechanically ventilated patients.
III. Studies validating SVV's ability to predict fluid responsiveness was performed at average tidal volume 8mL/kg, while supine, and in the absence of abdominal insufflation [2,3,4]

Objectives

I. Evaluate the effects of abdominal insufflation, change in Tidal volume (TV), and and patient positioning on intrathoracic pressure, SVV, lung compliance, and TV
II. Evaluate the utility of measuring esophageal pressure intraoperatively

Methods

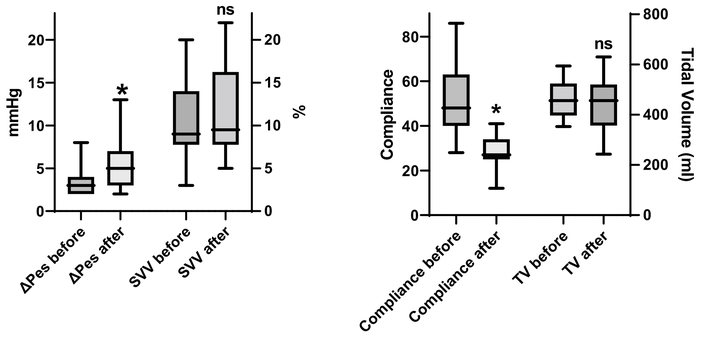
I. Approved by Human Subjects Research Committee
II. Patients undergoing elective laparoscopic procedures
III. Observational study recording before and after measurements focused on abdominal insufflation, change in TV, and change in patient position.
IV. Placed an esophageal balloon catheter after induction to measure esophageal pressure
V. Edwards HemoSphere advanced monitoring platform to measure SVV
VI. Recorded before and after intervention measurements for esophageal pressure, lung compliance, TV, and SVV

References

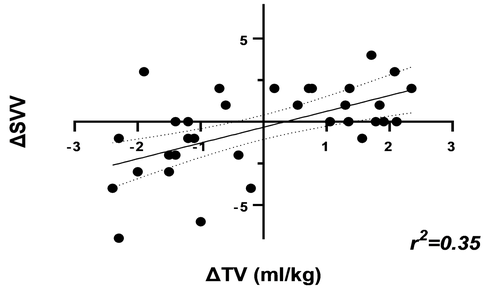
I. Talmor D, et al. N Engl J Med. 2008 Nov 13;359(20):2095-104.
II. Berkenstadt H, et al. Anesth Analg 2001;92(4):984-9.
III. Reuter DA, et al. Crit Care Med 2003;31(5):1399-404.
IV. Cannesson M, et al. Crit Care Med 2003;31(5):1399-404.

Results

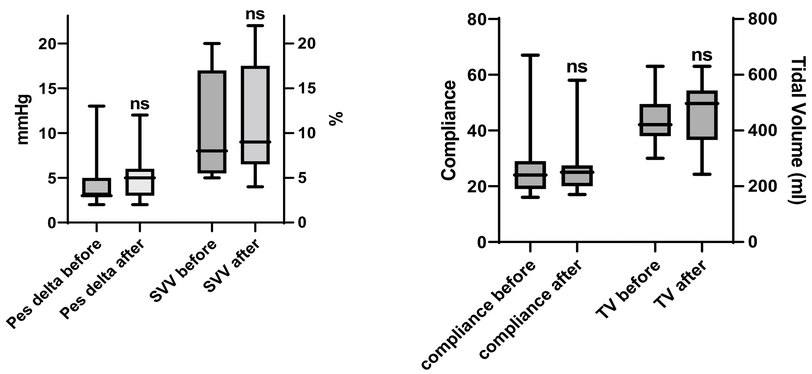
Effects of Abdominal Insufflation



Effects of Tidal Volume Change



Effects of Trendelenburg Positioning



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Conclusion

I. Abdominal insufflation
  i. Increases the variability of esophageal pressure (ΔPes)
  ii. Leads to decreased lung compliance
  iii. Has no significant effect on Stroke volume variation or TV
II. Tidal Volume
  i. Increases in TV correlates with increased SVV
  ii. Decreases in TV correlates with decreased SVV
  iii. Pearson correlation coefficient r=0.58
III. Trendelenburg
  i. Changing patient position from supine to Trendelenburg position had no significant impact on esophageal pressure variability, SVV, lung compliance, or tidal volume
  ii. Trendelenburg Positioning does not have the same effect on SVV as passive leg raise

Next Steps

I. Collect more data to confidently establish the relationship between abdominal insufflation, ΔPes, and lung compliance
II. Further research includes an experimental study controlling tidal volume and measuring SVV values at tidal volumes of exactly 6ml/kg ideal body weight and 8ml/kg ideal body weight
III. Passive leg raise has been shown to increase venous return to the heart and subsequently decrease SVV. Further research includes actively comparing SVV in patients with passive leg raise and in Trendelenburg

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